

# PATENT SPECIFICATION



Application Date: May 29, 1922. No. 15,067 / 22.

203,033

Complete Left: Jan. 16, 1923.

Complete Accepted: Aug. 29, 1923.

## PROVISIONAL SPECIFICATION.

### Improvements in Escalators.

I, WILLIAM SEBASTIAN GRAFF-BAKER, of 15, Queens Road, Ealing, London, W. 5, a citizen of the United States of America, do hereby declare the nature of this invention to be as follows:—

This invention relates to improvements in escalators. The object of the invention is to overcome and remove certain difficulties and objections which are experienced in escalators as at present constructed.

As usually constructed, an escalator is composed of steps mounted on four wheels, two on each side.

The two wheels on one side are mounted in different vertical planes (looked at in the direction of travel) at the ends of a bar or yoke, to the middle of which the end of the step frame is secured, yoke and wheels lying outside the step width.

Each wheel of the two runs on separate tracks arranged in different vertical planes. On the upper side of the sloping portion of the machine the tracks are displaced horizontally, one to the rear of the other, a distance equal to the horizontal distance between the two step wheels. Consequently these step wheels will be level and the yoke and step horizontal.

On the upper side of the horizontal portions of the machine the tracks are horizontal and side by side so that both step wheels are still level and their step horizontal.

Suitable curves are arranged at transition points from slope to level and *vice versa*.

On the horizontal and sloping underside portions of the machine the two tracks are side by side except that one is raised slightly above the other for purposes of clearance.

It will be seen that the most inaccessible portions of the machine—i.e. on the slope—are the most complicated while the accessible portions are simpler.

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The yokes at the opposite sides of the step are connected together not only by the step but also by a spindle or axle passing from one to the other. The steps are connected together by a driving chain passing from and connecting axle to axle.

In order to disconnect the chain at any point the corresponding axle must be withdrawn, since it passes through the driving chain and its length makes this difficult except at selected points.

The driving chain requires to be provided with safety links, in case it should break when the escalator is loaded with passengers.

The steps pass from top side to bottom side on curved track structures known as carriages. Each wheel has its own track and over certain stretches a guard track.

To provide clearances these tracks must be of peculiar shapes and the track arrangement is very complicated.

Where steps and their chain pass over the driving sprocket, the reaction of the teeth tends to lift the steps and this movement is prevented only by check tracks arranged over the four step wheels on the top side tracks.

Since the step wheels wear unequally these check tracks must be arranged to allow the largest wheel to pass and the smaller wheels can therefore lift, causing noise and wear.

Moreover, there must be some clearance allowed, since the same wheel has also to roll on the track in an opposite direction to that which would be set up by the check rail. This precludes using spring mounted check rails.

There is still left out of consideration the wear in the step wheel bushes and spindles, which cannot be dealt with when the same wheel is used both for supporting the step and checking lifting.

According to the present invention each step has four wheels, but only two at a time are used on the slope.

One wheel on each side of the step is outside the step width and a little to one side (up the slope) of the centre line in the side or end view.

- 5 The other wheel on each side of the step is at the end of an arm or yoke projecting down the slope away from the step centre line and inside of the step width.
- 10 The yoke or wheel carrying arm at either side is rigidly bolted to the underside of the step frame, so that the yoke moves as a whole with the step. The outer wheels are mounted freely on axles passing through the yoke beneath its point of attachment to the step frame, and these axles extend inwardly for a short distance, forming stub shafts which overlie or cross the outer ends of the yoke
- 15 arms from the next step. On the inner sides of the yoke arms are formed stout lugs, in positions in which they will be engaged by the ends of the arms of the next step, when the steps are passing over the escalator. In plan view on the "go" side the yoke arms run parallel with the line of travel from the step frame to level
- 20 of the next step above, then incline inwards, till level with the axles of the outer wheels on the next step below, then again run parallel with the line of travel. The inner wheels are mounted freely on stub spindles at the inner sides of the
- 25 free ends of the yoke arms.

- 30 The first or outer wheel is not used on the top or "go" side of the slope but an inward extension of its spindle rests on the end of the arm or yoke of the step above, thus making one pair of wheel (i.e. the inner wheels at each end of a step) support one step, yet giving a stable support by bearing on the next step (e.g. the following step on the "go" side).
- 35 The outer wheel therefore is free to revolve backwards when passing under a check rail in the neighbourhood of the driving sprocket, this check rail being
- 40 spring supported and adjustable to meet all conditions of wheel and bush wear.
- 45 On the return side the outer wheels alone are used and the yokes now in their turn rest on the extensions of the outer
- 50 wheel spindles of the next step (e.g. the following step).

- 55 There are thus only two travelling rails used on the top ("go") and bottom ("return") portions of the slope, instead
- 60 of four, and only half the number of check rails.

At the bends from slope to flat the previously disused wheels are engaged by auxiliary tracks and the steps formed

65 from a stair to a platform, or *vice versa*.

When passing round the carriages the yokes of adjacent steps come into contact and the number of tracks required in the carriage is thus reduced. The carriage tracks can all be made of a circular type and renewable.

The chain is secured to each step by a pin or spindle forming part of the chain joint being extended outwards to engage in two brackets suitably disposed on the underside of the step thus allowing the removal of a short pin disconnecting the chain.

Further, in the event of the chain breaking, the extensions of the outer wheel spindles engage in hooks formed on the ends of the yokes of the next step, and prevent the steps parting more than a small amount and rendering unnecessary the use of safety links.

These hooks are formed to stand up (on the "go" side) on the straight free ends of the yoke arms, and are hooked inwards, towards the step or fixed end of the arms. The top of the hook engages with the lug of the next downhill yoke arm when the steps are going over the carriages.

It will be noticed that the above mentioned form of construction has the effect of:

- (1) Simplifying the machine at the least accessible points i.e. on the slope;
  - (2) Providing a sound method of applying check rails independent of wheel size;
  - (3) Providing an inherent safety device for the main chain;
  - (4) Simplifying the carriage track work by reducing the number of tracks and using circular shapes only, without at the same time introducing any additional complications at other points.
  - (5) Permitting a narrower machine to be constructed for a given step width.
  - (6) Rendering a short and simple matter the disconnecting of the chain both from the steps and link from link.
- The tracks may be made to rest on cross bearers secured to the tunnel walls or on stanchions embedded in concrete on the slope and to the stanchions supporting the landings on the horizontal portions.
- Stanchions may be provided to support any cross bearers at the centre where more than one machine is installed in one tunnel.

The main driving reduction gearing may be the same as used at present but plain spur gearing with a chain drive from the motors would be preferable.

The shunt belt on the present type of machine could be dispensed with and its place taken by a bar of wood. The hand-rail gear may be much simpler than that

at present used and the handrail may be made to return in a trough rather than on a track.

- 5 The number of sizes of chain sprocket wheels for handrail drive may be reduced to not more than three and of handrail drive wheels to not more than two.

Clutches may be provided for disengaging the handrail drives in case of defects.

Dated this 29th day of May, 1922.

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## COMPLETE SPECIFICATION.

### Improvements in Escalators.

- 15 I, WILLIAM SEBASTIAN GRAFF-BAKER, of 15, Queens Road, Ealing, London, W. 5, a citizen of the United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

- 20 This invention relates to improvements in escalators. The object of the invention is to overcome and remove certain difficulties and objections which are experienced in escalators as at present constructed.

- 25 The invention broadly consists in an escalator comprising steps having four wheels, the arrangement being such that two only, one towards each side of a step, engage or travel upon an inclined track at a time.

- 30 According to the invention an escalator is provided with four tracks, a single pair for the inclined part of the upper or "go" side and a single pair for the inclined part of the lower or return side of the escalator.

- 35 Of the four step wheels, a wheel towards each side of a step may be carried by an arm or yoke extending to such a position that the next adjacent step below it engages and rests thereupon during travel upon an incline of the escalator. Further, a second pair of the four wheels of a step may be carried by a step in advance of those wheels which are carried by arms or yokes, the arrangement being such that the steps when on the incline of the upper or "go" side are supported and travel upon the wheels carried by the yokes while when the steps are on the incline of the lower or return side of the escalator they are supported or travel upon the other wheels.

- 40 Further features of the invention will hereinafter be described and delimited by the claims.

In the accompanying drawings:—

- 45 Figure 1 is a diagrammatic side elevation of an escalator according to one form of the invention and showing a short length of slope or inclined track;

Figure 2 is a side elevation partly in section of a pair of steps illustrating the invention;

Figure 3 is a plan view according to Figure 1 with the steps removed, showing the arrangement of the wheels and other parts on one side of the steps;

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Figure 4 is a fragmentary front elevation of one of the steps with wheels and other parts according to Figures 2 and 3, and

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Figure 5 is a side elevation of a carriage or curved tracks or guards suitable for use at the upper platform of an escalator such as illustrated in Figure 1.

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In carrying the invention into effect according to one convenient mode, each step *a* of the escalator has a pair of wheels *b* and *c* upon each side thereof. One wheel *b* of each step is outside the step width and a little to one side (up the slope) of the centre line in the side or end view.

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The other wheel *c* on each side of a step is at the end of an arm or yoke *d* projecting down the slope away from the step centre line and inside of the step width.

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The yoke or wheel carrying arm *d* at either side is rigidly bolted to the underside of the step frame *a*<sup>1</sup> so that the yoke moves as a whole with the step. The outer wheels *b* are mounted freely on axles *e* passing through the yoke beneath its point of attachment to the step frame, and these axles extend inwardly for a short distance, forming stub shafts which overlie or cross the outer ends of the yoke arms from the step next above. On the inner sides of the yoke arms are formed stout lugs *d*<sup>2</sup> in positions in which they will be engaged by the ends of the arms of the next step, when the steps are passing over the carriages or arcuate tracks (see Figure 1) at the top and bottom of the escalator. The yoke arms (viewed in plan, see Figure 3) lie parallel with the line of travel from the step frame to a point level with the wheels carried by the yokes of the next step above, then incline inwards as at *d*<sup>3</sup>, till level with

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the axles of the outer wheels on the next step below, then again are formed to lie parallel with the line of travel.

Each yoke or arm  $d$  is formed adjacent its extremity with a hook or upwardly curved part  $d^3$  adapted to engage, under certain circumstances, the stub axles  $e$  and at certain times the outer surface is adapted to bear against the lugs  $d^1$  of the next preceding yoke, as will be referred to hereinafter.

The inner or yoke wheels  $c$  are mounted freely on stub spindles at the inner sides of the free ends of the yoke arms.

The outer wheel  $b$  of a step is not used on the upper or "go" side of the slope, that is to say, it does not engage a track, but an inward extension of its spindle as at  $e$  rests on the end of the arm or yoke  $d$  of the step above, thus making one pair of wheels (*i.e.*, the inner wheels  $c$  at each end of a step) support one step, stability of support being given by each step bearing on the yokes of the next step up the slope.

The outer wheels  $b$  therefore are free to revolve backwards when passing under a check rail in the neighbourhood of the driving sprocket, this check rail being spring supported and adjustable to meet all conditions of wheel and bush wear.

On the return or under side of the escalator the outer wheels  $b$  alone are used or adapted to engage the track and the yokes now in their turn rest on the extensions of the outer wheel spindles  $e$  of the next step up the slope.

The escalator has only two travelling tracks or rails  $f$  and  $g$ , that lettered  $f$  being upon the upper or "go" portion while track or rail  $g$  is upon the lower or "return" portion of the incline of the escalator. Thus it will be observed that the escalator has two tracks or rails only instead of four and that only half the number of check rails are required.

At the bends from slope to flat the previously disused wheels (for example,  $b$  on the "go" side) are engaged by auxiliary tracks  $f^1$  and the steps formed from a stair to a platform, or *vice versa*.

A carriage for the upper end of an escalator (see Figure 5) comprises arcuate tracks  $f^2$  and  $f^3$ , the track  $f^2$  providing a continuation of the upper track  $f$  and the track  $f^3$  a continuation of the auxiliary track  $f^1$ . The auxiliary track  $g^1$  receives the wheels  $c$  as they emerge from the track  $f^3$  on the return side of the escalator. A third track or guard  $g^3$  is mounted upon or forms part of the carriage and merges into the track  $g$ . A corresponding carriage is provided at the lower end of the escalator as indicated in dotted lines in Figure 1.

When passing round the carriages the lugs  $d^1$  of the yokes of one step come into contact or bear against the hooks  $d^3$  of the yokes of the next step, as shown in Figure 1.

It will be appreciated that by the above described arrangement of carriage and the mutual support of the steps the number of tracks required upon a carriage is reduced, the tracks may be all made of a concentric arcuate type and are renewable.

The chain of the escalator may be secured to each step by a pin or spindle  $h$  forming part of the chain joint and extended outwards to engage in two brackets  $h^1$  suitably disposed on the underside of the step, thus allowing the removal of a short pin to disconnect the chain.

In the event of the chain breaking, the extensions of the outer wheel spindles  $e$  engage in the hooks  $d^3$  formed on the ends of the yokes of the next step and prevent the steps parting more than a small amount and rendering unnecessary the use of safety links.

It will be noticed that the above-mentioned form of construction has the effect of:

- (1) Simplifying the machine at the least accessible points, *i.e.*, on the slope;
- (2) Providing a sound method of applying check rails independent of wheel size;
- (3) Providing an inherent safety device for the main chain;
- (4) Simplifying the carriage track work by reducing the number of tracks and using circular shapes only, without at the same time introducing any additional complications at other points;
- (5) Permitting a narrower machine to be constructed for a given step width;
- (6) Rendering a short and simple matter the disconnecting of the chain both from the steps and link from link.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. An escalator comprising steps having four wheels, the arrangement being such that two only, one towards each side of a step, engage or travel upon a track at a time.
2. An escalator having the features claimed in Claim 1 and comprising four tracks, a single pair for the inclined part of the upper or "go" side and a single pair for the inclined part of the lower or return side of the escalator.
3. An escalator as claimed in Claim 1 or 2, characterised in this that of the four step wheels a wheel towards each side

of a step is carried by an arm or yoke extending to such a position that the next adjacent step engages and rests thereupon during travel upon an incline of the escalator.

4. An escalator as claimed in Claim 3, characterised in this that of the four step wheels a second pair of wheels, one towards each side of a step, is carried by the step in advance of those carried by the arms or yokes.

5. An escalator as claimed in Claims 3 and 4, characterised in this that the steps when on the incline of the upper or "go" side are supported and travel upon the wheels carried by the yokes or arms and that the steps when on the incline of the lower or return side of the escalator are supported and travel upon the wheels upon the steps.

6. An escalator as claimed in Claim 4 or 5, characterised in this that the yokes or arms extend rearwardly under the next following step and extended axles of the second pair of wheels are adapted to engage and rest upon the yokes or arms of the adjacent step during travel upon an incline of the escalator.

7. An escalator as claimed in Claim 2, 3, 4, 5 or 6, characterised in this that auxiliary tracks are provided at the upper and lower ends of the escalator for the horizontal or flat parts and for the transition from an incline to a horizontal or flat part.

8. An escalator as claimed in Claim 3, 4, 5, 6 or 7, characterised in this that during travel of the steps upon an arcuate path from the upper or "go" side to the lower or return side of the escalator and *vice versa* the yokes engage one another for the purpose specified.

9. An escalator as claimed in Claim 3, 4, 5, 6, 7 or 8, characterised in this that the arms are provided with hooks or

equivalent means which are adapted to engage a part upon the next step in the event of the chain of the escalator breaking.

10. An escalator as claimed in Claims 8 and 9, characterised in this that when the yokes or arms engage one another the engagement takes place between the upper parts of the hooks and lugs provided upon the yokes or arms.

11. An escalator as claimed in any of the preceding claims, characterised in this that the two wheels each side of a step are located in different vertical planes when viewed in plan or end elevation.

12. An escalator as claimed in any of the preceding claims, characterised in this that carriages are provided at the upper and lower ends of the escalator comprising concentric arcuate tracks.

13. An escalator as claimed in any of the preceding claims, characterised in this that a step is secured to the driving chain by a pin or spindle independent of the axles of the wheels of the step.

14. An escalator as claimed in Claim 13, characterised in this that the pin or spindle is mounted in bearings secured to a step located between the wheels toward one side of the step and the wheels toward the other side of the step.

15. An escalator as claimed in any of the preceding claims having check rails associated each with an inclined track in the region of the driving sprocket for the chain of the escalator and adapted to engage those wheels which are not in engagement with a track.

16. The improvements in escalators, substantially as described and as illustrated in the accompanying drawings.

Dated this 16th day of January, 1923.

MARKS & CLERK.

[This Drawing is a reproduction of the Original on a reduced scale]

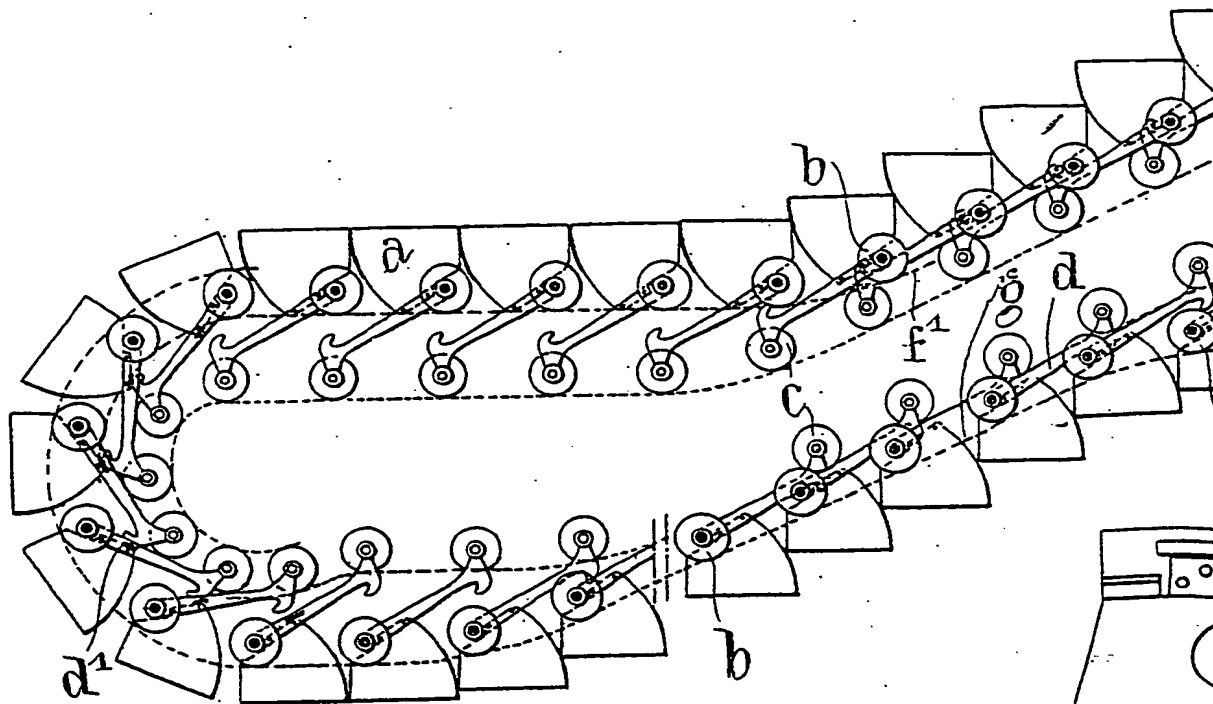


Fig. 1.

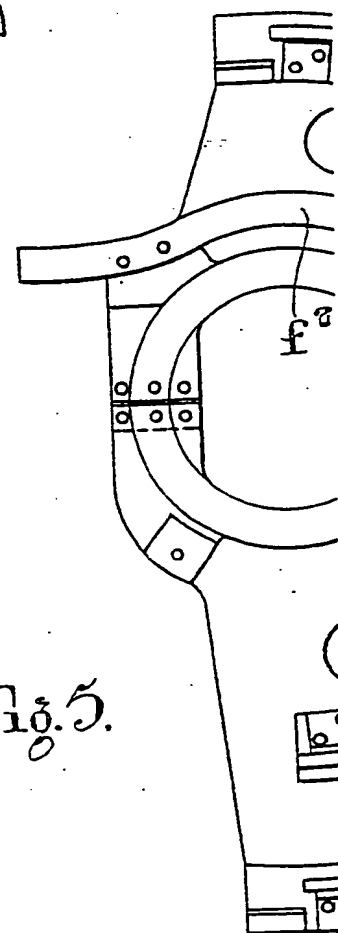
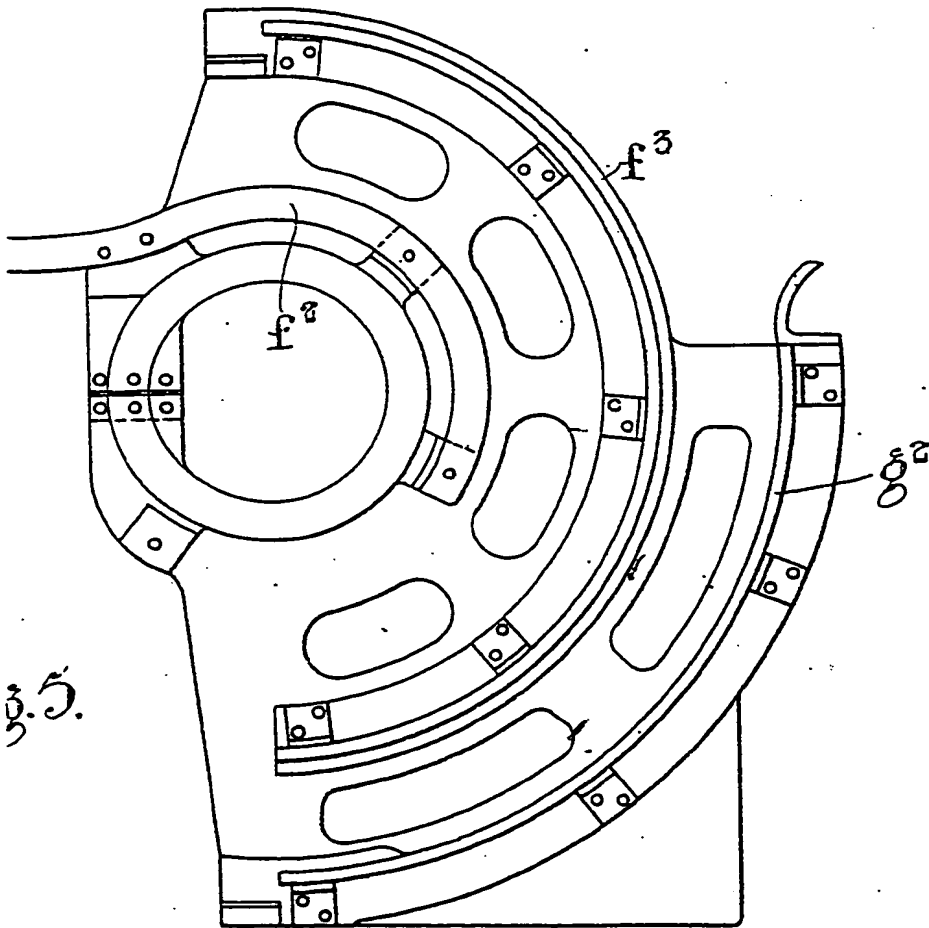
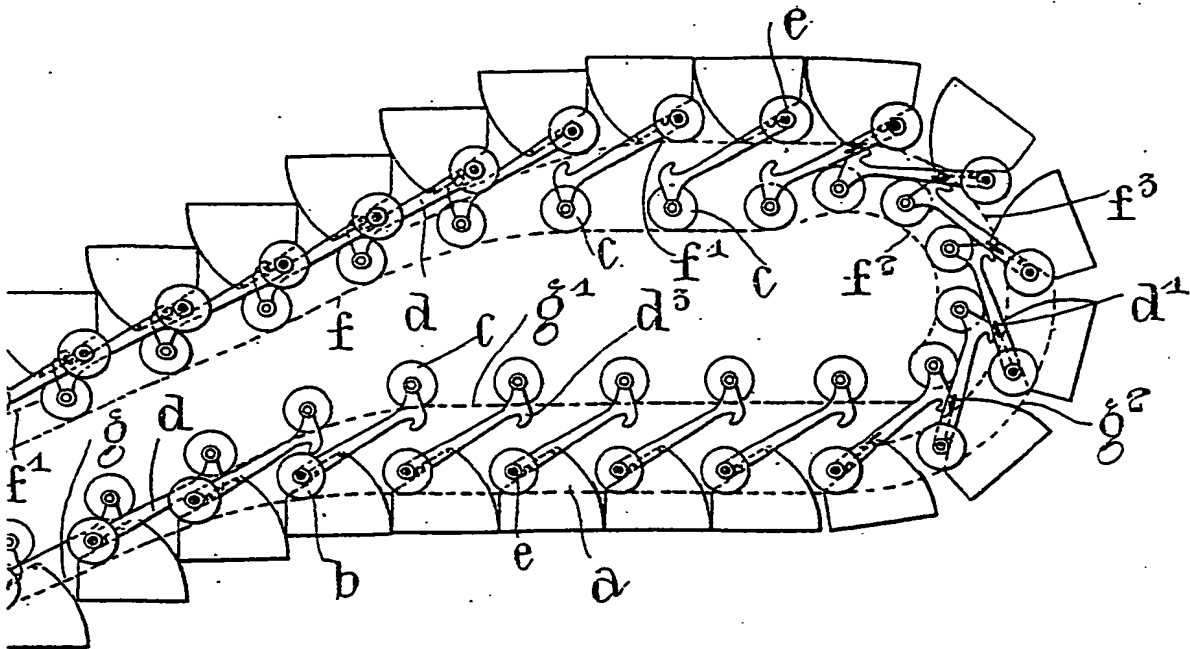


Fig. 5.



203,083 COMPLETE SPECIFICATION

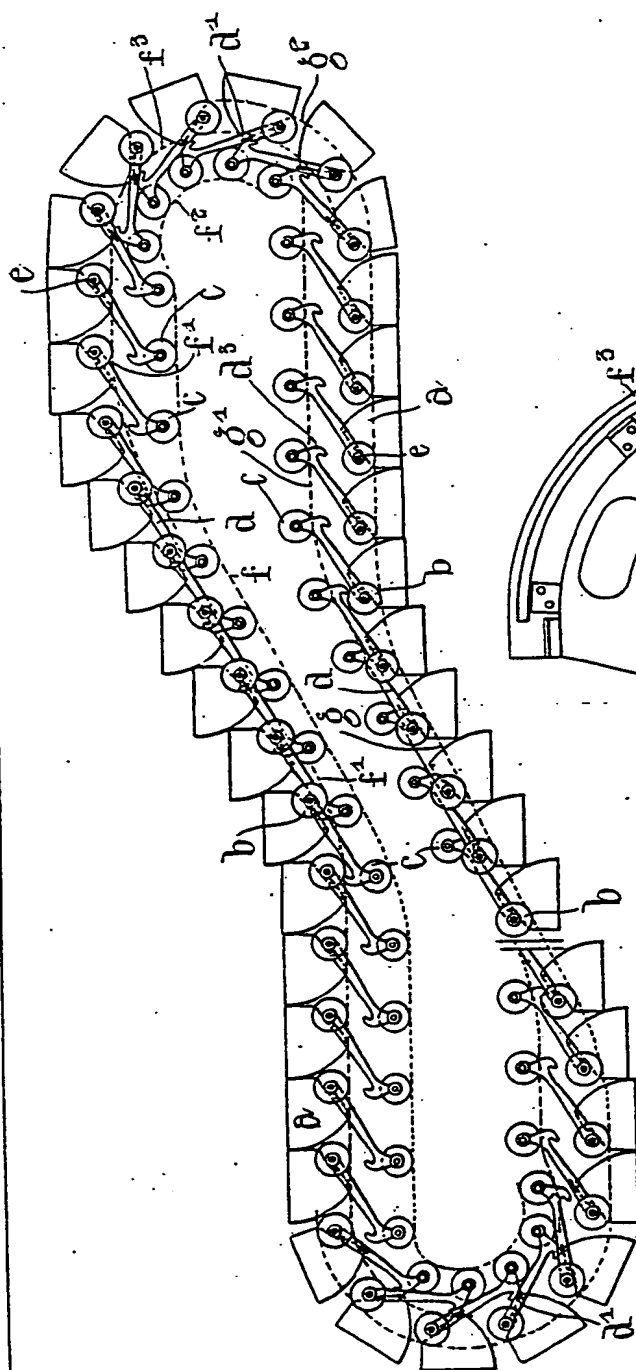


Fig. 1.

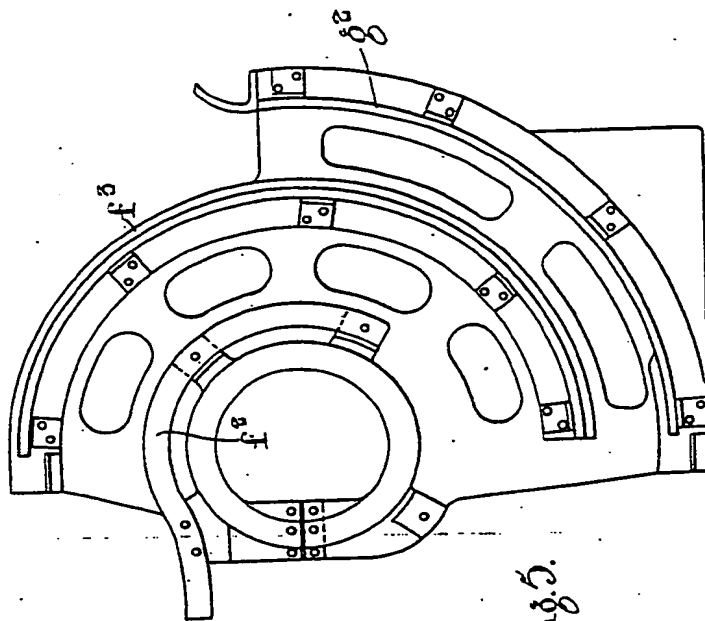
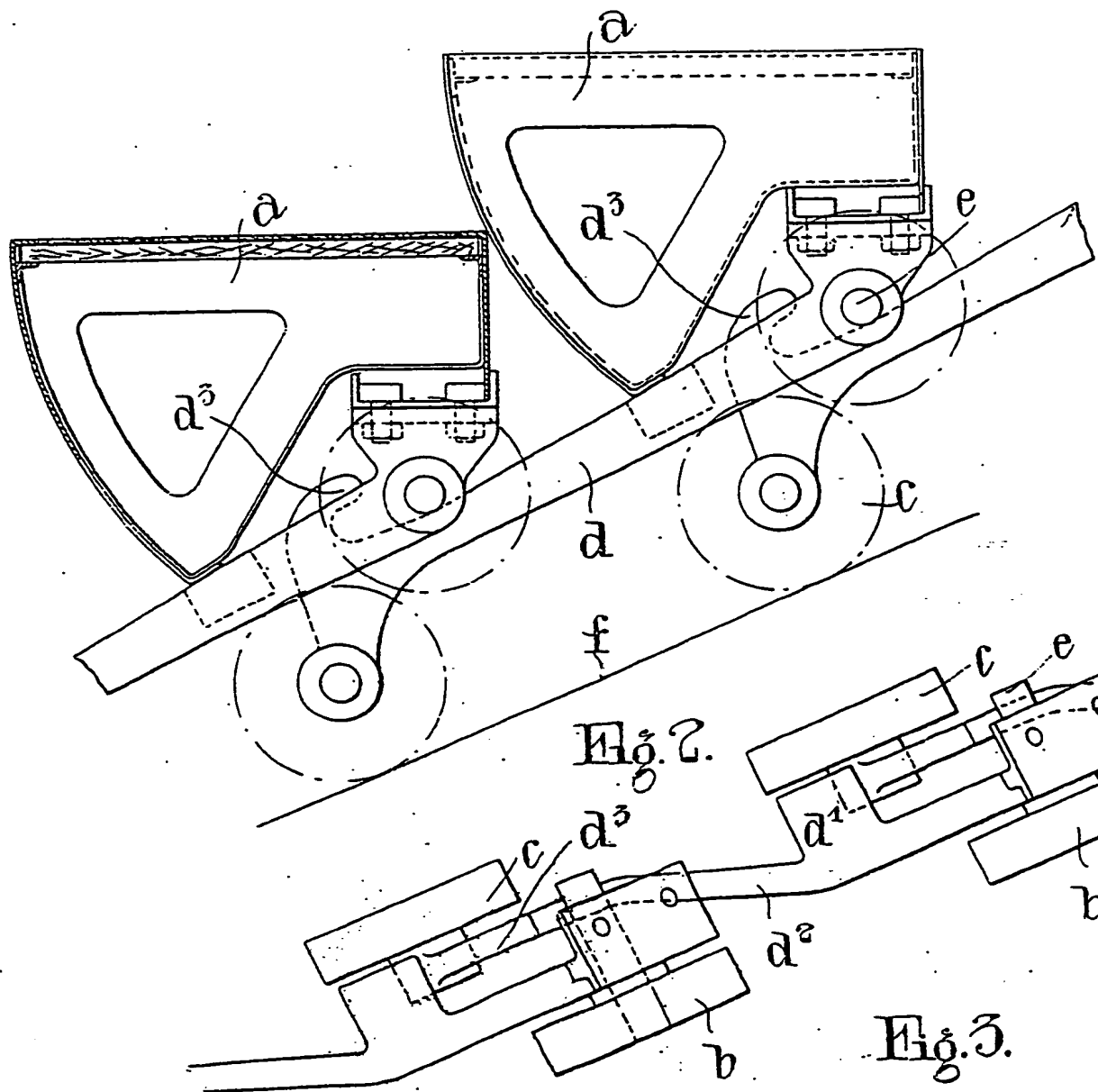


Fig. 2.

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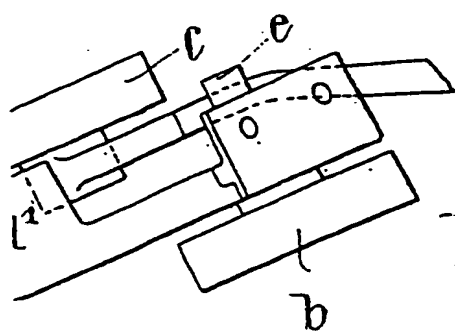
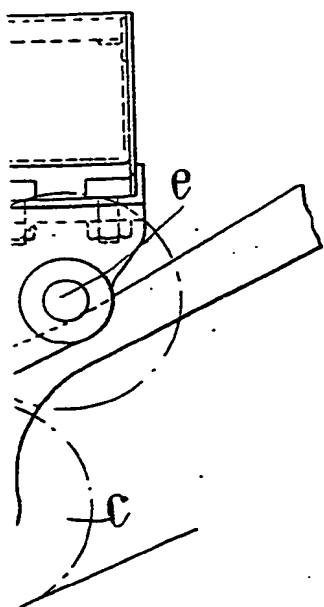


Fig. 3.

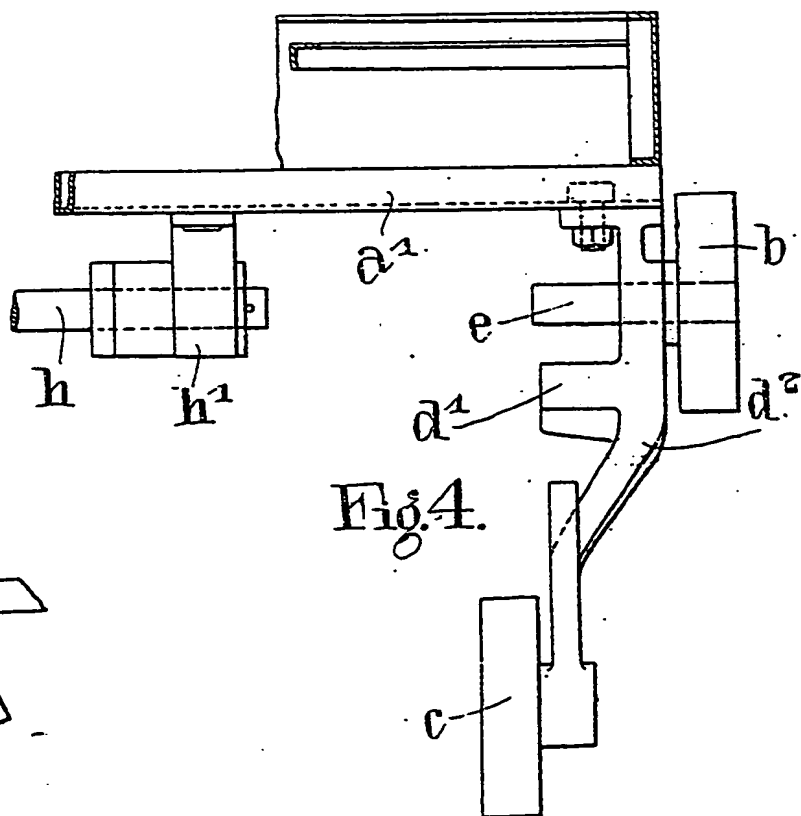
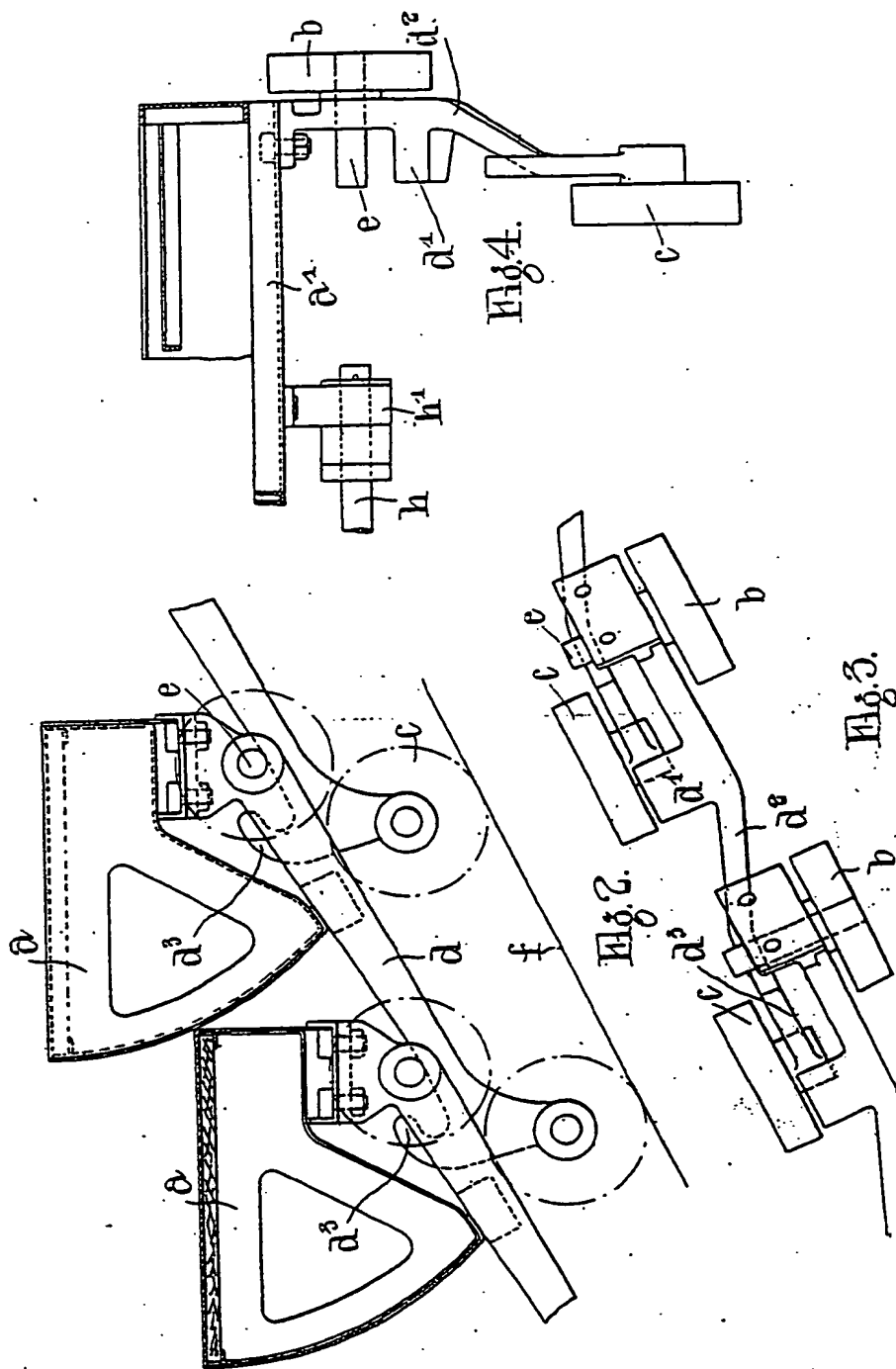


Fig. 4.

[This Drawing is a reproduction of the Original on a reduced scale]



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